

Law, Governance and Technology Series 3

Núria Casellas

# Legal Ontology Engineering

Methodologies, Modelling Trends,  
and the Ontology of Professional  
Judicial Knowledge

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Springer

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# Foreword

This is the third volume of the Law, Governance and Technology Series. The first one, also devoted to ontologies,<sup>1</sup> stressed the plurality of theoretical approaches and the diversity of applications that Semantic Web technologies have to offer to the legal domain. As Núria Casellas shows in this third one, legal ontologies come to the age as a specific set of related conceptual tools and techniques to assist people to perform better on their everyday tasks.

Short after the Internet and the World Wide Web, lawyers, judges and jurists have begun to realize that the use of technology has rapidly changed the habits of their working life. Sentencing, drafting or contracting are traditional legal tasks. However, they are nowadays performed following steps and internal processes which are already different. The way they are conducted now is not exactly the same as it was before, only 20 years ago.

This means that what we meant by “legal knowledge” has to be changed too. Legal knowledge becomes more complex as technology improves the way to handle it. Jurisprudence is not only a matter of legislation, rulings and doctrine. The way lawyers interact with information and knowledge systems is relevant as well.

In 2001, at the time we started up the Observatory of Judicial Culture in the Spanish Judicial School, only 20% of newly recruited judges had some computer skills. At present, all of them are used to browse over extended legal databases and, as we have had the opportunity to test several times along our Projects, they gather and compile freely information from the Internet—and not only from legislation, precedents and the case records—when ruling.

Here lies the reason why research on human-machine interaction, legal knowledge systems and Artificial Intelligence applications is so important for the law. Regulation will increasingly rely on our capability to convert massive information

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<sup>1</sup>See Sartor et al. (2011).

into structured knowledge. And we must figure out tools that help us to properly manage information in concrete contexts and situations.

Núria Casellas shows in this volume that legal core and domain ontologies are crucial to develop such tools. In doing so, she draws a broad landscape. But, beyond that, I think the reader will find an added value, because she has been able to show at the same time the details of the whole ontology lifecycle. She describes knowledge acquisition techniques, ontology building methodologies, and evaluation tests within the realistic environment of Courts and judicial settings.

The Ontology for Professional Judicial Knowledge (OPJK) introduced in the volume is the result of an extended empirical research and many attempts to capture the nuances of practical and judicial knowledge. I remember her surprise coming back from her first fieldwork in several Spanish Courts, after interviewing not only Magistrates but clerks, court experts and attorneys, and thinking of how to proceed with this legal knowledge which is not contained into the legal rules and written procedures. She acknowledged that difficult theoretical problems are always grounded on practical problems and common behavior that have to be well described and understood, first. From this point of view, the ability to share and reuse knowledge is but an extension of what humans naturally do in their social environments. And these complexities gave rise to some questions, such as:

How may we enable legal information interoperability? How may we foster legal knowledge usability and reuse between information and knowledge systems? How may we go beyond the mere linking of legal documents or the use of keywords or Boolean operators for legal information search? How may we formalize legal concepts and procedures in a machine-understandable form?

In short, how may we handle the complexity of legal knowledge to enhance legal information search and retrieval or knowledge management, taking into account the structure and dynamic character of legal knowledge, its relation with common sense concepts, the distinct theoretical perspectives, the flavor and influence of legal practice in its evolution, and jurisdictional and linguistic differences?<sup>2</sup>

This means a user-centered approach to legal ontology building. I like the questions she raises, and I am glad I could help to raise them.

UAB, February 2011

*Pompeu Casanovas*  
IDT Director

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<sup>2</sup>Extracted from the blogpost “Semantic Enhancement of Legal Information. Are We Up for the Challenge?” available at: <http://blog.law.cornell.edu/voxpath/2010/02/15/semantic-enhancement-of-legal-information%E2%80%A6are-we-up-for-the-challenge/>

# Preface

Current needs for legal information and content management demand better solutions towards legal knowledge representation to enhance legal information search and retrieval or knowledge management. With the introduction not only of syntax but also of meaning in information exchange, information retrieval and information management and organization shall be enhanced and automated reasoning might be implemented. The implementation of technologies for human-machine understanding are the basis for the development of legal semantic applications.

Nowadays, these attempts have been driven by the success of the WWW and, especially, by the Semantic Web Vision. Berners-Lee et al. (2001) described the Semantic Web as an extension of the Web “in which information is given well-defined meaning, better enabling computers and people to work in cooperation.” Thus, a shift from the current human-readable Web to the machine-readable Semantic Web, the use of knowledge representation languages and tools (ontologies) will allow semantics to be added to the Web or to semantic applications. Law, Knowledge Management and Artificial Intelligence thus converge in this interdisciplinary area of research.

This publication describes the ontologies as a type of knowledge representation and, specifically focuses on legal ontologies as the form of representation and formalization of legal knowledge, and discusses issues related to knowledge acquisition, knowledge extraction, modelling methodologies, tools for ontology construction, and ontology evaluation. For this, the book is devoted to the analysis of the definitions of ‘ontology’, and to offer an extensive account of legal ontologies present in the current literature.

From these initial analyses, this book will explore how legal experts or professionals may participate in legal ontology construction. To this end, this publication includes the experience of modeling an particular ontology for the legal domain, the Ontology of Professional Judicial Knowledge, as a case study. This ontology was developed during the participation of the Institute of Law and Technology (directed by Dr. Pompeu Casanovas) together with the software company iSOCO

in the nationally funded project Iuriservice, which, in turn, was one of the case studies of the European research project SEKT (Semantically Enabled Knowledge Technologies (EU-IST-2003-506826).

The Ontology of Professional Judicial Knowledge represents practical judicial knowledge (ethnography) for the construction of an *intelligent* software application for information search and retrieval. This application, Iuriservice, is a web-based decision support tool directed to newly incorporated judges and it aims at supporting decision-making during their on-call period (Casanovas et al. 2004, 2005b). The aim of the system is to discover the best semantic match between the user's question or input question (formulated in natural language) and a stored question, so as to offer an answer that satisfies the user (Blázquez et al. 2005). To find the question-answer pair that best matches the input question, the system is enhanced with knowledge representation techniques from the area of artificial intelligence: ontologies.

This publication is based on the Ph.D research "Modelling Legal Knowledge through Ontologies. OPJK: the Ontology of Professional Judicial Knowledge" that was defended at the Law School of the Universitat Autnoma de Barcelona (UAB), in December 2008. In turn, that research was the result of my work in the Iuriservice and SEKT (Semantically Enabled Knowledge) projects, at the Institute of Law and Technology (IDT-UAB).

Therefore, I would like to thank Prof. Pompeu Casanovas for giving me the opportunity to discover and conduct stimulating research in the area of Law and Technology and to participate in such projects. The Iuriservice<sup>1</sup> and the SEKT<sup>2</sup> projects not only provided the framework of my research, but also entailed an outstanding professional opportunity and personal experience. From these two projects, I would like to thank every partner for all their guidance, and fruitful discussions. Especially, I would like to thank John Davies, Frank van Harmelen, Zhisheng Huang, Aleks Jakulin, Michel Klein, Atanas Kiryakov, Stefan Schlobach, York Sure, Christopher Tempich, Ian Thurlow, Johanna Vlker, Denny Vrandecic, for their support and collaboration during the SEKT Project, and to Richard Benjamins, Mercedes Blzquez, Jess Contreras, Jos Manuel Lpez-Cobo, and Ral Pea from the iSOCO company in the Iuriservice project and the SEKT Legal case study. Finally, I would like to thank all the colleagues that worked and helped or contributed somehow to the development of the Iuriservice system and its ontology, including evaluation experts and the judges of Spanish School of the Judiciary.

I would also like to thank Mark Musen (Stanford Center for Biomedical Informatics Research) to allow me to prolong my stay in the United States after the ICAIL International 2007 conference, and to Daniela Tiscornia (Istituto di Teoria e Tecniche dell'Informazione Giuridica, ITTIG) for kindly allowing me to finish my thesis research in Italy.<sup>3</sup>

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<sup>2</sup>EU-IST-2003-506826.

<sup>3</sup>This stay in Italy was financially supported by AGAUR (2008-BE-I-00076).

The content of this book has been extended from that initial research in order to include more recent ontology modelling efforts. In this sense, I would like to express my gratitude for all the valuable comments and criticisms received by my thesis tribunal, reviewers and colleagues, which helped make significant improvements to this final publication: Joost Breuker, John Davies, Enrico Franceconi, Giovanni Sartor, Marco Schorlemmer, Daniela Tiscornia, etc. Moreover, I would also like to acknowledge some of the recent projects (such as OntoMedia or NEURONA), where I have participated in the ontology design and development tasks in these last years.<sup>4</sup>

I am also grateful to all my colleagues from the Institute of Law and Technology, and from the Legal Philosophy area, the Political Science and Public Law Department, and, in general, from the UAB Law School, for always supporting me and encouraging me in this and all other tasks. In particular, I would like to thank Josep Maria de Dios and Francesca Puigpelat, for all their help.

Special thanks to Joan-Josep Vallbé for all the unconditional support, fruitful discussions, comments, technical assistance, and version proof-reading. Needless to say that any inaccuracies or errors are but my own.

Last, but not least, I would like to thank my family and friends for their neverending patience and encouragement.

Bellaterra

*Núria Casellas*  
January 2011

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<sup>4</sup>ONTOMEDIA: TSI-020501-2008-131, Neurona (AVANZA) Project: TSI-200100-2008-134, SGR 2009SGR-0688, and CSO-2008-05536-SOCI.



# Acronyms

AAAI	Association for the Advancement of Artificial Intelligence
AI	Artificial Intelligence
AKEM	Application Knowledge Engineering Methodology
BATNA	Best Alternative to a Negotiated Agreement
CABALA	Consultazione Assistita di Basi di Dati di Leggi Ambientali
CODeP	Conceptual or Content Design Patterns
CLO	Core Legal Ontology
CContology	Customer Complaint Ontology
DODDLE	Domain Ontology rapid DeVeLopment Environment
DOLCE	Descriptive Ontology for Linguistic and Cognitive Engineering
EU	European Union
FBO	Frame-based Ontology of Law
FOLaw	Functional Ontology of Law
HCOME	Human-Centered Ontology Engineering Methodology
HTML	HyperText Markup Language
IAAIL	International Association for Artificial Intelligence and Law
ICAIL	International Conference on Artificial Intelligence and Law
IJCAI	International Joint Conference on Artificial Intelligence
IPRonto	Intellectual Property Rights Ontology
Jur-IWN	Jur-(Ital)Wordnet
KAON	Karlsruhe Ontology Management Infrastructure
KBS	Knowledge-based Systems
KM	Knowledge Management
KR	Knowledge Representation
KSE	Knowledge Sharing Effort
LKIF	Legal Knowledge Interchange Format
LLD	Language for Legal Discourse
MAS	Multi-Agent System
MTCO	Multi Tier Contract Ontology
NeOn	Networked Ontologies

NLP	Natural Language Processing
OCL.NL	Ontology of Dutch Criminal Law
ONIONS	ONtologic Integration On Nave Sources
OPJK	Ontology of Professional Judicial Knowledge
ORSD	Ontology Requirement Specification Document
OTK	On-To-Knowledge
OWL	Ontology Web Language
PROTON	PROTo ONtology
PSM	Problem-solving Method
RDF	Resource Description Language
SEKT	Semantically Enabled Knowledge Technologies
SKOS	Simple Knowledge Organization System
SPARQL	SPARQL Protocol and RDF Query Language
SUMO	Suggested Upper Merged Ontology
T2K	Text to Knowledge
UPON	Unified Process for ONtology
URI	Uniform Resource Identifier
UCC	US Uniform Commercial Code
W3C	World Wide Web Consortium
WWW	World Wide Web
XML	eXtensible Markup Language

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